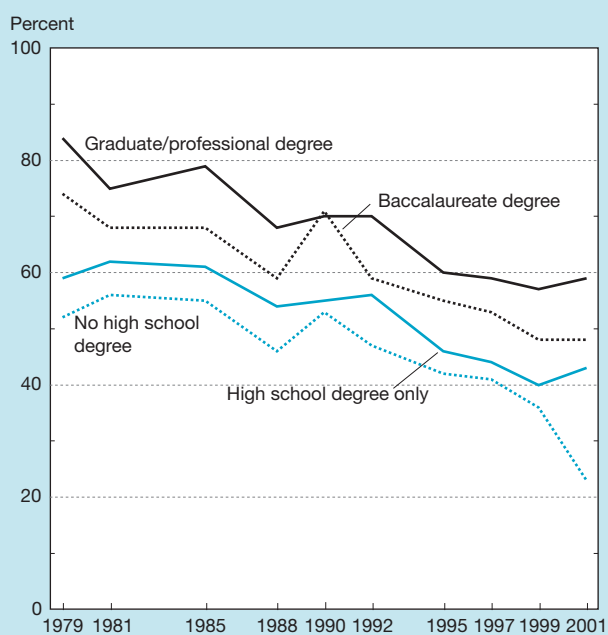


## Science in Newspapers and Museums

The decline in newspaper readership during the past decade has been well documented. According to the NSF survey, the percentage of all adults who read a newspaper every day dropped from 57 percent in 1990 to 41 percent in 1999. The decline is apparent at all education levels and continued for the less-than-high-school-education group through 2001. However, newspaper readership among the other three education groups either rose or stayed the same between 1999 and 2001, indicating that the overall decline in newspaper readership may have leveled off in recent years.<sup>47</sup> (See figure 7-20 and appendix table 7-48.)

Figure 7-20.  
U.S. public reading a daily newspaper: 1979–2001



See appendix table 7-47.

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Sixty-six percent of those surveyed in 2001 reported that they had visited a science or technology museum at least once during the past year, the highest level of museum attendance ever recorded by the NSF survey. Museum attendance is positively related to formal education and attentiveness to S&T. (See appendix tables 7-45, 7-49, and 7-50.)

<sup>47</sup>Data from the Pew Research Center also show a recent leveling off in the decline in newspaper readership. Data from the center show 47 percent of whites reading a daily newspaper compared with 37 percent of blacks and 32 percent of Hispanics. However, blacks are somewhat more likely (60 percent) than whites (56 percent) to watch TV news. In addition, weekly news magazines, such as *Time* and *Newsweek*, have lost readers. In 2000, only 12 percent reported that they regularly read a news magazine; the corresponding statistics in 1996 and 1993 were 15 and 24 percent, respectively.

## Science Fiction and Pseudoscience

### Interest in Science Fiction

According to renowned physicist Stephen Hawking, “science fiction is useful both for stimulating the imagination and for diffusing fear of the future.” Interest in science fiction may affect the way people think about or relate to science. For example:

- ♦ Interest in science fiction may be an important factor in leading men and women to become interested in science as a career. Although it is only anecdotal evidence, found on Internet discussion lists, for example, scientists often say they were inspired to become scientists by their keen interest in science fiction as children.
- ♦ It is useful to discover whether interest in science fiction is a possible indicator of positive attitudes toward S&T. For example, one study found a strong relationship between preference for science fiction novels and support for the space program.<sup>48</sup>

Thirty percent of those participating in the 2001 NSF survey said that they read science fiction books or magazines. (See appendix table 7-51.) The positive relationships that exist between reading science fiction and level of education, number of math and science courses completed, and attentiveness to science and technology are interesting, yet predictable. However, another finding is contrary to conventional wisdom. That is, there does not seem to be a gender gap: nearly equal percentages of men (31 percent) and women (28 percent) report that they read science fiction books or magazines. (See appendix table 7-51.)

However, a difference does exist with respect to watching science fiction television programs. For example, the Sci Fi channel is watched by more men (55 percent) than women (45 percent) (Brown 2000). In contrast, women make up the majority of the viewing audience of almost every other television network except the sports networks.

In response to the 2001 NSF survey, 35 percent of men reported that they watched any of the *Star Trek* series either regularly (12 percent) or occasionally (23 percent), compared with 28 percent of women who watched either regularly (10 percent) or occasionally (18 percent). There does not seem to be a relationship between level of education and watching *Star Trek*. (See appendix table 7-52.)

The *X-Files* is a show that focuses more on pseudoscience than science fiction. About 15 percent of those surveyed said they watch the show regularly, and another 28 percent said that they watch it occasionally. Those with more formal education are less likely than others to watch the show. (See appendix table 7-52.)

<sup>48</sup>The same study also found that students who read science fiction are much more likely than other students to believe that contacting extraterrestrial civilizations is both possible and desirable (Bainbridge 1982).

## Relationships Between Science and Pseudoscience

### What Is Pseudoscience?

Pseudoscience is defined here as “claims presented so that they appear [to be] scientific even though they lack supporting evidence and plausibility” (Shermer 1997, p. 33). In contrast, science is “a set of methods designed to describe and interpret observed and inferred phenomena, past or present, and aimed at building a testable body of knowledge open to rejection or confirmation” (Shermer 1997, p. 17). According to one group studying such phenomena, pseudoscience topics include yogi flying, therapeutic touch, astrology, fire walking, voodoo magical thinking, Uri Gellar, alternative medicine, channeling, Carlos hoax, psychic hotlines and detectives, near-death experiences, Unidentified Flying Objects (UFOs), the Bermuda Triangle, homeopathy, faith healing, and reincarnation (Committee for the Scientific Investigation of Claims of the Paranormal <<http://www.csicop.org>>).

### How Widespread Is Belief in Pseudoscience?

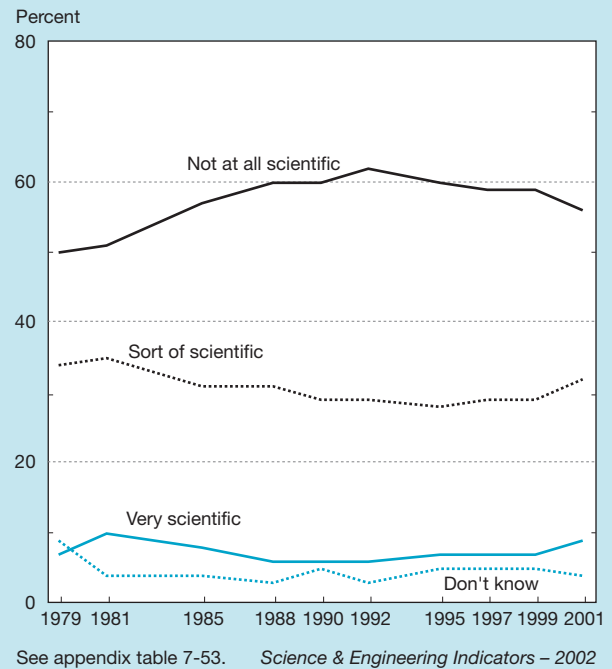
Belief in pseudoscience is relatively widespread. Various polls show the following:

- ◆ More than 25 percent of the public believes in astrology, that is, that the position of the stars and planets can affect people’s lives. In one recent poll, 28 percent of respondents said that they believed in astrology; 52 percent said that they did not believe in it; and 18 percent said that they were not sure (Newport and Strausberg 2001). Nine percent of those queried in the 2001 NSF survey said that astrology was “very scientific” and 32 percent answered “sort of scientific”; 56 percent said that it was not at all scientific. (See appendix table 7-53 and figure 7-21.) A minority of respondents (15 percent) said that they read their horoscope every day or “quite often”; 30 percent answered “just occasionally.” (See appendix table 7-54.)
- ◆ At least half of the public believes in the existence of extrasensory perception (ESP). The statistic was 50 percent in the latest Gallup poll and higher in the 2001 NSF survey, in which 60 percent of respondents agreed that “some people possess psychic powers or ESP.”<sup>49</sup> (See appendix table 7-55.)
- ◆ A sizable minority of the public believes in UFOs and that aliens have landed on Earth.<sup>50</sup> In 2001, 30 percent of NSF survey respondents agreed that “some of the unidentified flying objects that have been reported are really space vehicles from other civilizations” (see appendix table 7-56), and one-third of respondents to the Gallup poll reported that they believed that “extraterrestrial beings have visited earth at some time in the past.”

<sup>49</sup>Between 1972 and 1995, the Central Intelligence Agency and the Department of Defense spent \$20 million on “psychic” research (Barrett 2001).

<sup>50</sup>In a poll commissioned by *Popular Science* magazine, 45 percent thought that intelligent aliens had visited Earth (Popular Science 2000).

Figure 7-21.  
Public perception of whether astrology is scientific: 1979–2001



- ◆ Polls also show that one quarter to more than half of the public believes in haunted houses and ghosts, faith healing, communication with the dead (see figure 7-22), and lucky numbers (see appendix table 7-57).

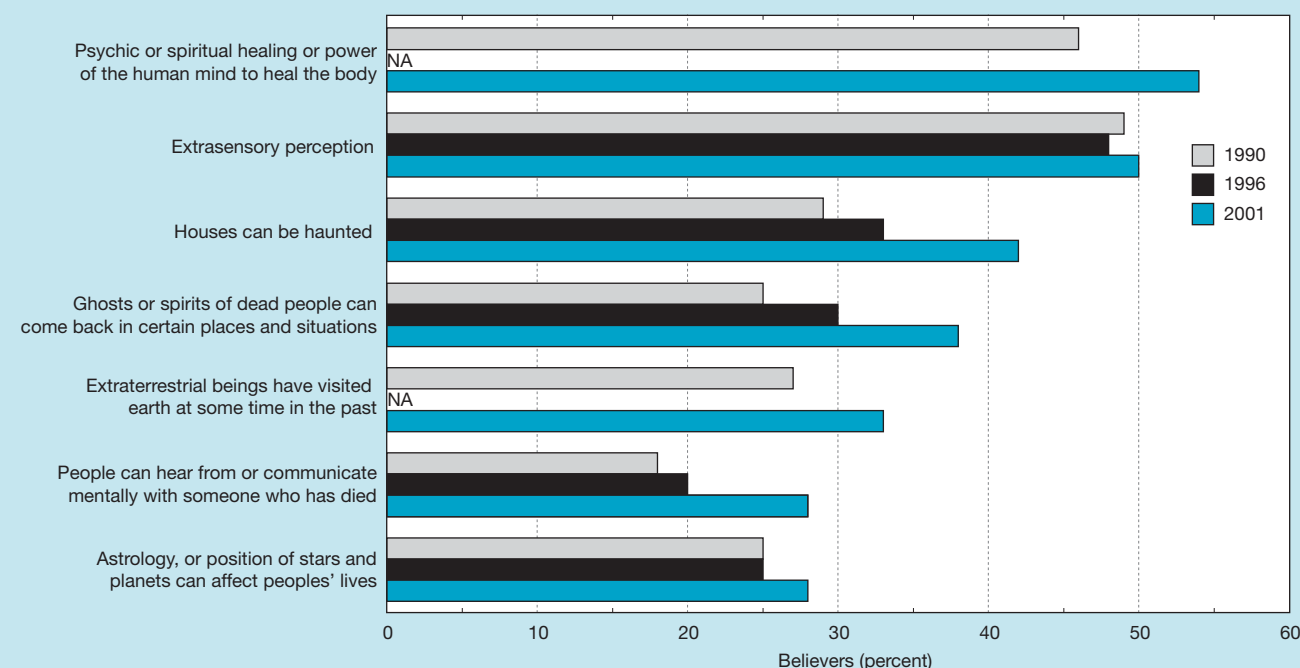
Surveys administered periodically even show increasing belief in pseudoscience. Of the 13 phenomena included in the 2001 Gallup survey, belief in 8 of them increased significantly during the past decade, and belief in only 1 (devil possession) declined. Belief in four of the phenomena, haunted houses, ghosts, communication with the dead, and witches, had double-digit percentage point increases. Movies like *The Sixth Sense* and *The Blair Witch Project* as well as the plethora of mediums on the small screen may have been fueling such beliefs.

In most cases, more women than men believe in these types of pseudoscience. In response to the 2001 NSF survey, women were more likely than men to believe in ESP.<sup>51</sup> The percentages of men and women who said that they believed in UFOs were about equal, which contrasts with the findings of other surveys. In fact, in most other surveys of this type, aliens-from-outer-space-type questions are the only ones that show higher levels of belief among men than women (Irwin 1993).

The relationship between level of education and belief in pseudoscience is not as straightforward, although for some topics such as astrology, a strong negative relationship exists. In response to the 2001 NSF survey, only 45 percent of those with less than a high school education and 52 percent of those who

<sup>51</sup>Although women account for only 45 percent of the Sci Fi Channel’s viewing audience, one show on that network, *Crossing Over*, which features a medium, has a largely female audience (Brown 2000).

Figure 7-22.  
Belief in paranormal phenomena



NA = not available

SOURCE: Gallup Organization, "Americans' Belief in Psychic Paranormal Phenomena is up Over Last Decade," (Princeton, NJ, 2001).

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had completed high school but not college said that astrology "is not at all scientific" compared with 74 percent of those who had at least a bachelor's degree. (See appendix table 7-53.)

### Is Belief in Pseudoscience Harmful?

Concerns have been raised, especially in the science community, about widespread belief in pseudoscientific phenomena.<sup>52</sup> Scientists and others believe that the media, and in particular, the entertainment industry, may be at least partially responsible for the large numbers of people who believe in astrology, ESP, alien abductions, and other forms of pseudoscience.<sup>53</sup> Because not everyone who watches shows with pseudoscientific themes perceives such fare as merely entertaining fiction, there is concern that the unchallenged

manner in which some mainstream media portray pseudoscientific phenomena is exacerbating the problem and contributing to the public's scientific illiteracy.<sup>54</sup> Belief in pseudoscience may indicate a lack of critical thinking skills (Maienschein et al., 1999).

Although scientists are concerned about scientific illiteracy, including the public's gullibility regarding pseudoscience, few choose to say much about it. According to physicist Robert L. Park, most scientists would rather talk about their latest cutting-edge research, not the basic laws of thermodynamics.<sup>55</sup> Park has been speaking out for many years. In explaining why, he recently said:

[P]eople drawn to [pseudoscience long] for a world that is some other way than the way it is. They pose no great threat to science. [Pseudoscience] is a sort of background noise, annoying, but rarely rising to a level that seriously interferes with genuine scientific discourse. The more serious threat is to the public, which is not often in a position to judge which claims are real and which are [not]. Those who are fortunate

<sup>52</sup>The rise of pseudoscience in China has become a growing concern for scientists in that country. According to one scientist, "the number of high-profile attempts to pass off superstition and money-making scams under the respectable cloak of science is one of the most disturbing features of Chinese science and society" (Tsou 1998).

<sup>53</sup>Groups like the Committee for the Scientific Investigation of Claims of the Paranormal <<http://www.csicop.org>> contend that shows like *The X-Files* fuel belief in misinformation about science and conspiracy theories, and several studies of this subject also support this contention (Sparks, Nelson, and Campbell 1997). Others have spoken out similarly: "[t]he UFO conspiracy theory has been fed and watered by *The X-Files* series on television" (Borger 2001). According to Richard Dawkins, in his 1998 treatise *Unweaving the Rainbow: Science, Delusion, and the Appetite for Wonder*, the show "systematically purveys an anti-rational view of the world which, by virtue of its recurrent persistence, is insidious."

<sup>54</sup>Another recent example of the media covering, and thus giving credence to, pseudoscience was a story posted on the Fox News website (Patrick Riley, "After 25 Years, Martian 'Face' Still Raises Questions") on September 8, 2000, about whether or not there's a "face" on Mars, two years after the Mars *Global Surveyor* sent back data providing conclusive evidence that the object was a natural geographical formation. An online poll on the website produced the following results: 37 percent said it was made by aliens, 31 percent thought it was a natural geographical feature, and 32 percent answered that they thought there was not enough data to decide either way.

<sup>55</sup>Robert Park, speech at the National Press Club, July 13, 2000.

enough to have chosen science as a career have an obligation to help the public make that distinction (Park 2000).

### **How Are Policymakers and Scientists Confronting Public Belief in Pseudoscience?**

Members of the science policymaking community concerned about scientific literacy among the general public tend to focus on improving the quality of formal science and mathematics education, usually at the precollege level, and the communication of science-related information to adults, for example, media coverage of topical issues such as biotechnology and global warming. Special committees at both the NSF and the National Academy of Sciences have been studying how to improve the latter. Several reports have been issued (National Science Board 2000). All of these endeavors seem to be directed at how to increase media coverage of science. However, none of the reports addresses the subject of *miscommunication* of science by the media. Most of this miscommunication involved the promotion of pseudoscience and the inaccurate portrayal of the scientific process.

A recent example of this miscommunication was the purported documentary, shown on the Fox Network, “Conspiracy Theory: Did We Land on the Moon?”<sup>56</sup> Astronomers and other members of the scientific community were highly critical of the way science (and everything else) was portrayed on the show.<sup>57</sup> However, the program was so popular with the public it was repeated twice within a six-month period.<sup>58</sup>

### **Belief in Alternative Medicine**

Alternative medicine is another concern. As used here, alternative medicine refers to all treatments that have not been proven effective using scientific methods. A scientist’s view of the situation appeared in a recent book (Park 2000):

Between homeopathy and herbal therapy lies a bewildering array of untested and unregulated treatments, all labeled *alternative* by their proponents. Alternative seems to define a culture rather than a field of medicine—a culture that is not scientifically demanding. It is a culture in which ancient traditions are given more weight than biological science, and anecdotes are preferred over clinical trials. Alternative therapies steadfastly resist change, often for centuries or even millennia, unaffected by scientific advances in the understanding of physiology or disease. Incredible explanations invoking modern physics are sometimes offered for how alternative therapies might work, but there seems to be little interest in testing these speculations scientifically.<sup>59</sup>

<sup>56</sup>The program first aired on February 15, 2001, and was repeated on March 21, 2001.

<sup>57</sup>A comprehensive critique of this program can be found at <<http://www.badastronomy.com>>.

<sup>58</sup>A 1999 Gallup poll showed that about 6 percent of Americans have doubts about the moon landing; the Fox show claimed the number is 20 percent.

<sup>59</sup>In 1992, Congress created the National Center for Complementary and Alternative Medicine within the National Institutes of Health. With an annual budget of around \$100 million, the Center funds research on alternative therapies to find out if they really do work. In addition, a White House Commission on Complementary and Alternative Medicine Policy is currently studying and will be making recommendations to Congress on how to promote research and training in alternative medicine.

In response to the 2001 NSF survey, an overwhelming majority (88 percent) agreed that “there are some good ways of treating sickness that medical science does not recognize.” (See appendix table 7-58.) The American Medical Association defines alternative medicine as any diagnostic method, treatment, or therapy that is “neither taught widely in U.S. medical schools nor generally available in U.S. hospitals.” However, at least 60 percent of U.S. medical schools devote classroom time to the teaching of alternative therapies, generating controversy within the scientific community. Critics have also been quick to note that one of these therapies, “therapeutic touch,” was taught at more than 100 colleges and universities in 75 countries before the practice was debunked by a nine-year-old child for a school science project (Rosa 1998).

Nevertheless, the popularity of alternative medicine appears to be increasing. A recent study documented a 50 percent increase in expenditures and a 25 percent increase in the use of alternative therapies between 1990 and 1997 (Eisenberg et al. 1998). A large minority of Americans (42 percent) used alternative therapies in 1997 and spent a total of at least \$27 billion on them. In addition, the authors of the study reported that the use of alternative therapies was:

- ♦ at least as popular in other industrialized nations as it was in the United States;
- ♦ more popular among women (49 percent) than among men (38 percent) and less popular among African Americans (33 percent) than among members of other racial groups (44.5 percent); and
- ♦ higher among those who had attended college, among those who had incomes above \$50,000, and among those who lived in the western United States.

Furthermore, among the 16 therapies included in the study, the largest increases between 1990 and 1997 were in the use of herbal medicine (a 380 percent increase), massage, megavitamins, self-help groups, folk remedies, energy healing, and homeopathy.<sup>60</sup>

Among those who reported using energy healing, the most frequently cited technique involved the use of magnets. In 2001, NSF survey respondents were asked whether or not they had heard of magnetic therapy, and if they had, whether they thought that it was *very scientific*, *sort of scientific*, or *not all scientific*. A substantial majority of survey respondents (77 percent) had heard of magnetic therapy. Among all who had heard of this treatment, 14 percent said it was *very scientific* and another 54 percent said it was *sort of scientific*. Only 25 percent of those surveyed answered correctly, that is, that it is *not at all scientific*.<sup>61</sup> These percentages vary by level of formal education. That is, among those who had not completed high school, only 18 percent chose the *not-at-all-sci-*

<sup>60</sup>The massive increase in herbal medicine is probably attributable to passage of the Dietary Supplement and Health Education Act of 1994, which allows manufacturers to market and sell herbal remedies without having to prove that they are effective.

<sup>61</sup>Researchers have yet to demonstrate that magnetic therapy is effective in treating pain or any other ailment (Park 2000).



entific response, as did 22 percent of the high school graduates, compared with 35 percent of the college graduates. Among those classified as attentive to S&T, 34 percent answered correctly. (See appendix table 7-59.)

## Conclusion

Although Americans express a high level of interest in S&T, they lack confidence in their knowledge of these subjects. In 2001, less than 15 percent thought that they were well informed about S&T. In addition, few Americans follow news stories about scientific breakthroughs, research, and exploration. Those with more years of formal education and those who have taken more courses in science and mathematics are more likely than others to express a high level of interest in S&T and to believe that they are well informed.

Data on science literacy in the United States indicate that most Americans do not know a lot about S&T. The percentage of correct responses to a battery of questions designed to assess the level of knowledge and understanding of science terms and concepts has not changed appreciably in the past few years. In addition, approximately 70 percent of Americans do not understand the scientific process. Individuals with more years of formal schooling and who have completed more courses in science and mathematics were more likely than others to provide correct responses to the science literacy questions.

Americans have highly positive attitudes toward S&T, strongly support the Federal Government's investment in basic research, and have high regard for the science community. In addition, most people believe that scientists and engineers lead rewarding professional and personal lives, although a stereotypical image of these professions, rooted in popular culture, does exist and has been difficult to dislodge.

Some individuals harbor reservations about science and technology, especially about technology and its effect on society. Although anti-biotechnology sentiments are much more common in Europe, U.S. support for genetic engineering has declined during the past 15 years.

The vast majority of the public believes that global warming exists and that it should be treated as a serious problem. However, Americans think that environmental pollution is not one of the most important problems facing the country today. They are more concerned about economic and especially education issues—more than two-thirds believe that the quality of science and mathematics education in American schools is inadequate.

Belief in pseudoscience is relatively widespread and growing. In addition, the media have come under criticism, especially by scientists, for sometimes providing a distorted view of science and the scientific process and thus contributing to scientific illiteracy.

Americans get most of their information about the latest developments in S&T from watching television, although the Internet is beginning to make inroads. It is now the leading source of information on specific scientific issues. The rapid growth of information technologies, including the Internet, is thoroughly explored in chapter 8, "Significance of Information Technologies."

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